

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of)	
Satish Gunturi et al.)	Group Art Unit: 2826
Application No.: 10/527,993)	Examiner: Thomas L Dickey
Filed: October 17, 2005)	Appeal No.: _____
For: PRESS PACK POWER)	
SEMICONDUCTOR MODULE)	

SUPPLEMENTAL APPEAL BRIEF

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This appeal is from the decision of the Primary Examiner dated June 23, 2008 finally rejecting claims 1-9, which are reproduced as the Claims Appendix of this brief.

This Appeal Brief is intended to replace the Brief filed on September 24, 2008. No fee is due with this paper since the fee for the Appeal Brief was paid on September 24, 2008.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

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I. Real Party in Interest

ABB Schweiz AG is the real party in interest, and is the assignee of Application No. 10/527,993.

II. Related Appeals and Interferences

The Appellant's legal representative, or assignee, does not know of any other appeal or interferences, which will affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

III. Status of Claims

A. There are 9 total claims currently pending in the application.

B. Current status of the claims

1. Claims canceled: None
2. Claims withdrawn from consideration but not canceled: None
3. Claims pending: 1-9
4. Claims allowed: None
5. Claims rejected: 1-9
6. Claims on appeal: 1-9

IV. Status of Amendments

No amendments were filed subsequent to the final Office Action dated August 23, 2008.

V. Summary Claimed Subject Matter

Appellant' Figures 1 and 2 illustrate an exemplary press pack module in which a semiconductor chip 2 is sandwiched between a conductive base plate 4 and a

conductive top plate 3 (pg. 5, lines 4-7). A contact piston 5 is mounted on the top plate 3, and presses the top plate 3, the semiconductor chip 2, and the base plate 4 (pg. 5, lines 7-8). A first module power connection 11 is mounted on the contact piston 5 and the base plate 4 is mounted on a second module power connection 12 (pg. 5, lines 8-11). The pressure applied between the first and second module power connections 11 and 12 flattens any bow in the composite top and base plates 3 and 4 that occurs based on manufacturing or processing conditions (pg. 5, lines 11-13).

The table that follows maps Appellant's independent claims to those portions of the disclosure that support the recited feature.

Claim #	Claim Feature	Support
1	High-power press pack semiconductor module, comprising: - an electrically conducting base plate;	pg. 5, lines 4-7; Fig. 1 element 4
	- at least one electrically conducting top plate;	pg. 5, lines 5-7; Fig. 1, element 3
	- a contact piston in pressing contact with the top plate;	pg. 5, lines 7-8; Fig. 1, element 5
	- at least one semiconductor chip including semiconductor material, a first main electrode that makes contact with the base plate forming an interface and a second main electrode that makes contact with the top plate,	pg. 5, lines 4-7; Fig. 1, element 2
	- a first module power connection in pressing contact with the base plate; and	pg. 5, lines 8-11; Fig. 1, element 11
1	- a second module power connection in pressing contact with the contact piston;	pg. 5, lines 8-11; Fig. 1, element 12

Claim #	Claim Feature	Support
	wherein a material is provided adjacent at least one of said first or second main electrodes that, together with the semiconductor material forms a eutectic alloy or an alloy whose melting point is below that of the semiconductor material, and	pg. 6, lines 18-24
	wherein at least one of said base plate or top plate is made of metal matrix composite material comprising two-dimensional randomly distributed short cut graphite fibers in the interface in an Al or Ag matrix, whose coefficient of thermal expansion is close to that of the semiconductor material, said metal matrix composite material containing said alloy-forming material.	pg. 5, lines 14-15; pg. 5, lines 16-28
5	High-power press pack semiconductor module comprising: - an electrically conducting base plate;	pg. 5, lines 4-7; Fig. 1 element 4
	- at least one electrically conducting top plate;	pg. 5, lines 5-7; Fig. 1, element 3
	- at least one semiconductor chip including semiconductor material, a first main electrode that makes contact with the base plate forming an interface and a second main electrode that makes contact with the top plate,	pg. 5, lines 4-7; Fig. 1, element 2
	- a contact piston in pressing contact with the top plate;	pg. 5, lines 8-11; Fig. 1, element 11
	- a first module power connection in pressing contact with the base plate; and	pg. 5, lines 8-11; Fig. 1, element 11
	- a second module power connection in pressing contact with the contact piston;	pg. 5, lines 8-11; Fig. 1, element 12
5	wherein a material is provided adjacent at least one of said first or second main electrodes that, together with the semiconductor material forms a eutectic alloy or an alloy whose melting point is below that of the semiconductor material, and	pg. 6, lines 18-24

Claim #	Claim Feature	Support
	- wherein at least one of said base plate or top plate is made of metal matrix composite material comprising of two-dimensional randomly distributed short cut graphite fibers in the interface in an Al or Ag matrix, whose coefficient of thermal expansion is close to that of the semiconductor material, said metal matrix composite material containing said alloy-forming material,	pg. 5, lines 14-15; pg. 5, lines 16-28
	- said metal matrix composite material having a metal content of at least 25 percent by volume,	pg. 6, lines 4-15
	- said metal matrix composite material comprising a metallic matrix alloy with a semiconductor material, and	pg. 6, lines 4-15
	- said metallic matrix alloy having a semiconductor material content up to the semiconductor material content of a eutectic composition.	pg. 6, lines 16-32

VI. Grounds of Rejection to be Reviewed on Appeal

The claims on appeal are rejected in the final Office Action under the following grounds:

1. Claims 1-3, 8, and 9 are rejected under 35 U.S.C. §103(a) for alleged unpatentability over *Lang et al* (U.S. Patent No. 6,426,561) in view of *Tsuruoka* (U.S. Patent No. 4,403,242) and *Kogo et al.* (U.S. Patent No. 5,437,921); and

2. Claims 4-7 stand rejected under 35 U.S.C. §103(a) for alleged unpatentability over the *Lang*, *Tsuruoka*, and *Kogo* patents as applied to claim 1, and further in view of *Pepper et al* (U.S. Patent No. 3,770,488).

VII. Argument

1. Appellant claims are distinguishable over the combination of the *Lang*, *Tsuruoka*, and *Kogo* patents

A. The *Lang*, *Tsuruoka*, and *Kogo* patents fail to establish a prima facie case of obviousness with respect to claim 1

The *Lang* patent discloses an insulated gate bipolar transistor (IGBT) module having a semiconductor 4 that includes main electrodes 5, 6 formed on a top face and bottom face of the semiconductor, respectively. A layer 7 is mounted between one of the main electrodes 5, 6, and an adjacent metallic contact surface.

The Examiner appears to allege that the layer 7 is analogous to Appellant's claimed base and top plates. Appellant disagrees because the *Lang* patent fails to disclose that the layer 7 is made of a metal matrix composite (MMC) material. Rather, the layer 7 is described as being composed of a paste or metal foil. Neither of which have the mechanical or structural characteristics of an MMC.

In an interview conducted on October 21, 2008, the Examiner alleged that the layer 7 as described in the *Lang* patent is analogous to the claimed material that is adjacent to the electrodes and the foils or wafers (see col. 2, lines 50-57) are analogous to Appellant's claimed top plate and base plate. Appellant disagrees since, as described in the reference, the foils or wafers can be disposed between the electrode 5 and substrate 2 and between the electrode 6 and piston 3. There does not appear to be any provision for disposing the foils or wafers between either the layer 7 and piston 3 or between the layer 7 and substrate 2, or otherwise between the piston 3 and substrate 2 and the respective semiconductor 5, 6 as shown in Fig.

1. Even when taking the knowledge of one of ordinary skill, Appellant does not

believe that the *Lang* patent provides the requisite guidance to disclose or suggest Appellant's claimed layer structure.

The *Tsuruoka* patent is applied in an effort to cure the deficiencies of the *Lang* patent as it relates to the base plate and top plate being formed of the same metal matrix material as recited in Appellant's claim 1. The *Tsuruoka* patent discloses a semiconductor device 100 that includes a metal-fiber composite material as an electrode. The semiconductor 100 includes a cathode electrode that is formed on a substrate 102. The cathode electrode 105 includes an upper piece 112 and a lower piece 111. The lower piece 111 is made of a metal-fiber composite material, which includes fibers (carbon, Mo, W) that are buried in a metal (Cu). The fibers being oriented concentrically (col. 4, lines 55-57).

The *Tsuruoka* patent fails to disclose or suggest that the metal fibers are randomly distributed short cut graphite as recited in Appellant's claims. Rather, the *Tsuruoka* patent discloses that carbon fibers are concentrically oriented around a center opening of the lower piece 111 (col. 4, line 34-35). One of ordinary skill would recognize that short-cut fibers cannot be used to achieve a concentric orientation as taught by the *Tsuruoka* patent, since the length of the fibers would frustrate the process of concentric achieving the desired orientation.

Thus, the *Tsuruoka* patent cannot remedy the deficiencies of the *Lang* patent with respect to this feature.

The *Kogo* patent was applied to remedy the acknowledged deficiencies of the *Lang* and *Tsuruoka* patents with respect to Appellant's claimed top or base plate being formed of a metal matrix composite material comprising two-dimensional randomly distributed short cut graphite fibers.

The *Kogo* patent discloses a base material for mounting electronic components, where the base material comprising aluminum or an aluminum alloy that is reinforced with carbon fibers, which are being arranged at random on a surface for mounting an electronic component. See Abstract.

While being generally related to the fabrication of a carrier and substrate in an electronic device, the teachings of the *Kogo* patent are not particularly related to the fabrication of a layer structure such as the press-pack module recited in Appellant's claims. Particularly, the *Kogo* patent fails to provide insight into how the disclosed base material can be comprised of eutectic alloy materials and be provided in a device structure to be in direct contact with a semiconductor chip as a top plate and bottom plate as recited in Appellant's claims. Rather, at best, the *Kogo* patent discloses the composite structure being in contact with a semiconductor device having a ceramic package (col. 5, lines 10-13).

In summary, the *Lang*, *Tsuruoka*, and *Kogo* patents when applied individually or collectively as suggested by the Examiner, fail to establish a *prima facie* case of obviousness. Particularly, the combined documents fail to establish a nexus between their respective teachings such that one of ordinary skill could reasonably conclude that a semiconductor having a first main electrode that makes contact with a base plate and a second main electrode that makes contact with a top plate, wherein at least one of said base plate or top plate is made of metal matrix composite material comprising of two-dimensional randomly distributed short cut graphite fibers in the plane of the interface in an Al or Ag matrix, whose coefficient of thermal expansion is close to that of the semiconductor material, said metal matrix composite material containing said alloy-forming material is achievable.

For example, the combined documents may arguably disclose a method of manufacturing a composite material for use in electronic devices but does not disclose a composite material that has structural relationship to a semiconductor material as recited in Appellant's claims. For these reasons, one of ordinary skill would have no reason to combine these teachings to achieve Appellant's claimed results. Accordingly, Appellant respectfully requests that this rejection not be sustained.

B. Claims 2, 3, 8, and 9 are patentable over the *Lang*, *Tsuruoka*, and *Kogo* patents

The aforementioned claims depend from one of independent claims 1 and 5. By virtue of these dependencies and because of the additional features recited therein, Appellant respectfully submits that the *Lang*, *Tsuruoka*, and *Kogo* patents fail to establish a *prima facie* case of obviousness with respect to claims 2, 3, 8, and 9. Accordingly, Appellant respectfully requests that this rejection not be sustained.

2. Claims 4-7 are distinguishable over the combination of the *Lang*, *Tsuruoka*, *Kogo*, and *Pepper* patents

A. Claim 5 does not read on the combination of the applied references

The Examiner relies on the *Pepper* patent in an attempt to address Appellant's claimed matrix comprising Au or Cu with a Si content of at most 13 percent as previously recited in claim 6. As noted by the Examiner, the *Pepper* patent discloses examples of metal matrices comprised of Al and Cu, among others, with a Si content of 13 percent or lower. The *Pepper* patent, however, does not remedy the deficiencies of the *Lang*, *Tsuruoka*, and *Kogo* patents with respect to Appellant's claimed base and top plates. For at least these reasons, a *prima facie* case of obviousness has not been established. Appellant respectfully requests that this rejection not be sustained.

B. Claims 4, 6, and 7 are distinguishable over the applied references

The aforementioned claims depend from one of independent claims 1 and 5. By virtue of these dependencies and because of the additional features recited therein, Appellant respectfully submits that the *Lang*, *Tsuruoka*, *Kogo*, and *Pepper* patents fail to establish a *prima facie* case of obviousness with respect to claims 4, 6, and 7. Accordingly, Appellant respectfully requests that this rejection not be sustained.

VIII. Claims Appendix

See attached Claims Appendix for a copy of the claims involved in the appeal.

IX. Evidence Appendix

No evidentiary exhibits are provided with this appeal.

X. Related Proceedings Appendix

No related proceedings are associated with this appeal.

XI. Conclusion

Appellant has pointed to errors in the rejection of the claims. Appellant respectfully requests that the final rejection be reversed and the application be returned to the Examiner for prompt allowance.

Respectfully submitted,

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Date November 24, 2008

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VIII. CLAIMS APPENDIX

The Appealed Claims

1. (Previously Presented) High-power press pack semiconductor module, comprising:

- an electrically conducting base plate;
- at least one electrically conducting top plate;
- a contact piston in pressing contact with the top plate;
- at least one semiconductor chip including semiconductor material, a first main electrode that makes contact with the base plate forming an interface and a second main electrode that makes contact with the top plate,
- a first module power connection in pressing contact with the base plate; and
- a second module power connection in pressing contact with the contact piston;

wherein a material is provided adjacent at least one of said first or second main electrodes that, together with the semiconductor material forms a eutectic alloy or an alloy whose melting point is below that of the semiconductor material, and

wherein at least one of said base plate or top plate is made of metal matrix composite material comprising two-dimensional randomly distributed short cut graphite fibers in the interface in an Al or Ag matrix, whose coefficient of thermal expansion is close to that of the semiconductor material, said metal matrix composite material containing said alloy-forming material.

2. (Original) Module as claimed in claim 1, wherein:

- said base plate and top plate are made of the same metal matrix composite material.

3. (Original) Module as claimed in claim 1, wherein:

- said metal matrix composite material has a metal content of at least 25 percent by volume.

4. (Original) Module as claimed in claim 3, wherein:

- said metal matrix composite material comprises a metallic matrix alloy with a semiconductor material.

5. (Previously Presented High-power press pack semiconductor module comprising:

- an electrically conducting base plate;
- at least one electrically conducting top plate;
- at least one semiconductor chip including semiconductor material, a first main electrode that makes contact with the base plate forming an interface and a second main electrode that makes contact with the top plate,
- a contact piston in pressing contact with the top plate;
- a first module power connection in pressing contact with the base plate; and
- a second module power connection in pressing contact with the contact piston;

wherein a material is provided adjacent at least one of said first or second main electrodes that, together with the semiconductor material forms a eutectic alloy or an alloy whose melting point is below that of the semiconductor material, and wherein

- at least one of said base plate or top plate is made of metal matrix composite material comprising of two-dimensional randomly distributed short cut graphite fibers in the interface in an Al or Ag matrix, whose coefficient of thermal expansion is close to that of the semiconductor material, said metal matrix composite material containing said alloy-forming material,

- said metal matrix composite material having a metal content of at least 25 percent by volume,

- said metal matrix composite material comprising a metallic matrix alloy with a semiconductor material, and

- said metallic matrix alloy having a semiconductor material content up to the semiconductor material content of a eutectic composition.

6. (Previously Presented) Module as claimed in claim 5, wherein:

- said matrix comprises Au or Cu with a Si content of at most 13 percent.

7. (Original) Module as claimed in claim 4, wherein:

- said metallic matrix alloy has a semiconductor material content that is tailored depending on the thickness of the semiconductor material such that the hotspot alloy is in the eutectic range without bulk precipitation.

8. (Original) Module as claimed in claim 1, wherein:

- said at least one plate of a metal matrix composite material has a thickness of at least the thickness of the semiconductor material.

9. (Original) Module as claimed in claim 1, wherein:

- said base plate and said top plate are both made of metal matrix composite material, and

- said plates have a combined thickness of at least the thickness of the semiconductor material.

IX. EVIDENCE APPENDIX

None

X. RELATED PROCEEDINGS APPENDIX

None